



70-006

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PRODUCT ENGINEERING/VALVES

VL:STDC:023

REV.00

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TDC FOR UNTOLERANCED DIMENSIONS IN CASTING & FORGING DRAWINGS

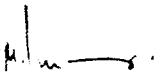
Scope :

This technical delivery condition specifies the tolerance for the untoleranced dimension for the castings and forgings wherever tolerances are not specified in the applicable drawing applicable material TDC.

A. Castings :

Nominal dimension (in mm)		Tolerance on diameter & height (in mm)
UPTO	4	± 0.5
OVER	4 UPTO 16	± 1.0
OVER	16 UPTO 65	± 1.5
OVER	65 UPTO 125	± 2.0
OVER	125 UPTO 250	± 2.5
OVER	250 UPTO 500	± 3.0
OVER	500 UPTO 1000	± 4.0
OVER	1000 UPTO 1600	± 5.0

B. Forgings : As per Table (1), (2), (3) & (4)



PREPARED



CHECKED



APPROVED

(S. KUMAR)
SM/PE/VSB
28/2/94

TABLE 1. LENGTH, WIDTH, HEIGHT, MISMATCH, RESIDUAL FLASH AND TRIMMED FLAT OF DROP, PRESS AND UPSET FORGINGS (NORMAL TOLERANCES)

DROP, PRESS & UPSET FORGINGS - TOLERANCES FOR: LENGTH, WIDTH & HEIGHT																					
MISMATCH	RESIDUAL FLASH (+) TRIMMED FLAT (-)	TRIM LINE		WEIGHT (KGS)	DIFFICULTY OF MATERIAL	COMPLEXITY	MISMATCH ; RESIDUAL FLASH & TRIMMED FLAT (DIA & LENGTH FOR UPSET FORGINGS)														
		ASYMMETRIC	STRAIGHT OR SYMMETRIC				NOTE: CENTRE TO SURFACE; STEP IN ONE DIE; + $\frac{1}{3}$, - $\frac{1}{3}$ OF TOTAL TOLERANCE														
							INTERNAL DIMENSION: REVERSE + AND - SIGNS.														
							MM														
							TO	32	100	160	250	400	630	1000	1600	2500					
							ABOVE	32	100	160	250	400	630	1000	1600	2500					
0.4	0.5	/	/	0-0.4	/	/	1.1 ^{+0.7} _{-0.4}	1.2 ^{+0.8} _{-0.4}	1.4 ^{+0.9} _{-0.6}	1.6 ^{+1.1} _{-0.8}	1.8 ^{+1.2} _{-0.8}	2 ^{+1.3} _{-0.7}									
0.5	0.6	/	/	0.4-10	/	/	1.2 ^{+0.8} _{-0.4}	1.4 ^{+0.9} _{-0.6}	1.6 ^{+1.1} _{-0.8}	1.8 ^{+1.2} _{-0.8}	2 ^{+1.3} _{-0.7}	2.2 ^{+1.5} _{-0.7}									
0.6	0.7	/	/	10-18	/	/	1.4 ^{+0.9} _{-0.6}	1.6 ^{+1.1} _{-0.8}	1.8 ^{+1.2} _{-0.8}	2 ^{+1.3} _{-0.7}	2.2 ^{+1.5} _{-0.7}	2.5 ^{+1.7} _{-0.8}	28 ^{+1.9} _{-0.9}								
0.7	0.8	/	/	18-32	/	/	1.6 ^{+1.1} _{-0.8}	1.8 ^{+1.2} _{-0.8}	2 ^{+1.3} _{-0.7}	2.2 ^{+1.5} _{-0.7}	2.5 ^{+1.7} _{-0.8}	2.8 ^{+1.9} _{-0.9}	32 ^{+2.1} _{-1.1}	36 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	45 ^{+2.4} _{-1.4}					
0.8	1	/	/	32-56	/	/	1.8 ^{+1.2} _{-0.8}	2 ^{+1.3} _{-0.7}	2.2 ^{+1.5} _{-0.7}	2.5 ^{+1.7} _{-0.8}	2.8 ^{+1.9} _{-0.9}	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}				
1	1.2	/	/	56-10	/	/	2 ^{+1.3} _{-0.7}	2.2 ^{+1.5} _{-0.7}	2.5 ^{+1.7} _{-0.8}	2.8 ^{+1.9} _{-0.9}	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}				
1.2	1.4	/	/	10-20	/	/	2.2 ^{+1.5} _{-0.7}	2.5 ^{+1.7} _{-0.8}	2.8 ^{+1.9} _{-0.9}	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}				
1.4	1.7	/	/	20-50	/	/	2.5 ^{+1.7} _{-0.8}	2.8 ^{+1.9} _{-0.9}	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}				
1.7	2	/	/	50-120	/	/	2.8 ^{+1.9} _{-0.9}	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}				
2	2.4	/	/	120-250	/	/	3.2 ^{+2.1} _{-1.1}	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}	10 ^{+3.1} _{-2.1}				
2.4	2.8	/	/		/	/	3.6 ^{+2.2} _{-1.2}	4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}	10 ^{+3.1} _{-2.1}	11 ^{+3.2} _{-2.2}				
QUALITY		(NORMAL)					4 ^{+2.3} _{-1.3}	4.5 ^{+2.4} _{-1.4}	5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}	10 ^{+3.1} _{-2.1}	11 ^{+3.2} _{-2.2}	12 ^{+3.3} _{-2.3}				
							5 ^{+2.5} _{-1.5}	5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}	10 ^{+3.1} _{-2.1}	11 ^{+3.2} _{-2.2}	12 ^{+3.3} _{-2.3}	14 ^{+3.4} _{-2.4}					
							5.6 ^{+2.6} _{-1.6}	6.3 ^{+2.7} _{-1.7}	7 ^{+2.8} _{-1.8}	8 ^{+2.9} _{-1.9}	9 ^{+3.0} _{-2.0}	10 ^{+3.1} _{-2.1}	11 ^{+3.2} _{-2.2}	12 ^{+3.3} _{-2.3}	14 ^{+3.4} _{-2.4}						

TABLE 2 THICKNESS FOR DROP, PRESS AND UPSET FORGINGS AND EJECTOR MARKS FOR DROP AND PRESS FORGINGS (NORMAL TOLERANCES)

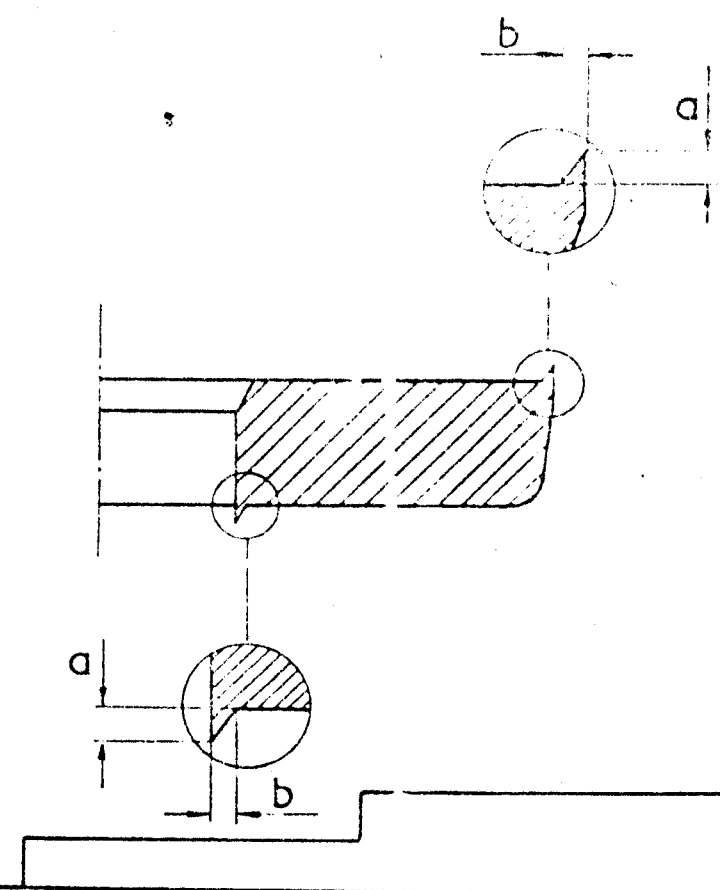
DROP, PRESS & UPSET FORGINGS - TOLERANCES FOR THICKNESS; EJECTOR MARKS*															
EJECTOR MARKS	WEIGHT (kg) ABOVE - TO (INCL)	DIFFICULTY OF MATERIAL M1 M2		COMPLEXITY				* (DROP AND PRESS FORGINGS ONLY)							
				S1 > 0.63 ≤ 1	S2 > 0.32 ≤ 0.63	S3 > 0.16 ≤ 0.32	S4 ≤ 0.16	M M							
								0 ABOVE	TO (INCL)	16	40	63	100	160	250
1	0-0.4							1	1.1	1.2	1.4	1.6	1.8	2	2.2
1.2	0.4-1.2							1.1	1.2	1.4	1.6	1.8	2	2.2	2.5
1.6	1.2-2.5							1.2	1.4	1.6	1.8	2	2.2	2.5	2.8
2	2.5-5							1.4	1.6	1.8	2	2.2	2.5	2.8	3.2
2.4	5-8							1.6	1.8	2	2.2	2.5	2.8	3.2	3.6
3.2	8-12							1.8	2	2.2	2.5	2.8	3.2	3.6	4
4	12-20							2	2.2	2.5	2.8	3.2	3.6	4	4.5
5	20-36							2.2	2.5	2.8	3.2	3.6	4	4.5	5
6.4	36-63							2.5	2.8	3.2	3.6	4	4.5	5	5.6
8	63-110							2.8	3.2	3.6	4	4.5	5	5.6	6.3
10	110-200							3.2	3.6	4	4.5	5	5.6	6.3	7
12.6	200-250							3.6	4	4.5	5	5.6	6.3	7	8
								4	4.5	5	5.6	6.3	7	8	9
								4.5	5	5.6	6.3	7	8	9	10
QUALITY (NORMAL)								5	5.6	6.3	7	8	9	10	11
								5.6	6.3	7	8	9	10	11	12
								6.3	7	8	9	10	11	12	

TABLE 3 STRAIGHTNESS, FLATNESS AND CENTRE TO CENTRE DIMENSIONS FOR DROP, PRESS AND UPSET FORGINGS

DROP, PRESS AND UPSET FORGINGS																
NOTE. QUALITY E DOES NOT APPLY TO UPSET FORGINGS																
RANGE OF TOLERANCES FOR STRAIGHTNESS AND FLATNESS																
LENGTH ABOVE TO (INCL)		MM														
		0 100	100 125	125 160	160 200	200 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250	1250 1600	1600 2000	2000 2500
QUALITY	NORMAL	0.6	0.7	0.8	0.9	1	1.1	1.2	1.4	1.6	1.8	2	2.2	2.5	2.8	3.2
RANGE OF TOLERANCES FOR CENTRE TO CENTRE DIMENSIONS																
LENGTH ABOVE TO (INCL)		MM														
		0 100	100 160	160 200	200 250	250 315	315 400	400 500	500 630	630 800	800 1000	1000 1250				
QUALITY	NORMAL	± 0.3 0.6	± 0.4 0.8	± 0.5 1	± 0.6 1.2	± 0.8 1.6	± 1 2	± 1.2 2.4	± 1.6 3.2	± 2 4	± 2.5 5	± 3.2 6.4				

TABLE 4 FILLET, EDGE RADII AND BURRS FOR DROP, PRESS AND UPSET FORGINGS

DROP, PRESS AND UPSET FORGINGS		
FILLET AND EDGE RADII TOLERANCES		
r MM	+	-
ABOVE - TO (INCL)		
0 - 10	50%	25%
10 - 32	40%	20%
32 - 100	32%	15%
> 100	25%	10%
BURR TOLERANCES (AND PARTING LINE FINIS FOR UPSET FORGINGS)		
WEIGHT (kg)	a	b
ABOVE - TO (INCL)		
0 - 1	1	0.5
1 - 6	1.6	0.8
6 - 40	2.5	1.2
40 - 250	4	2



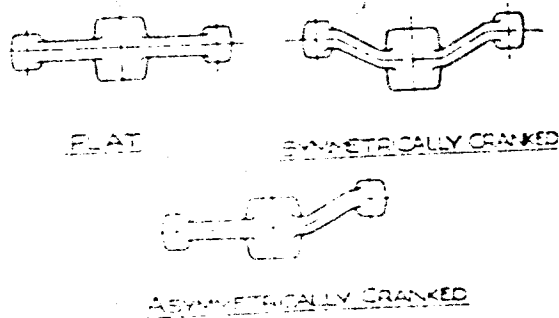
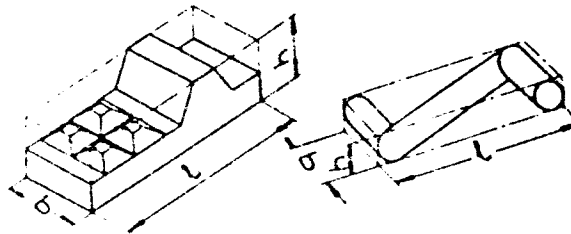
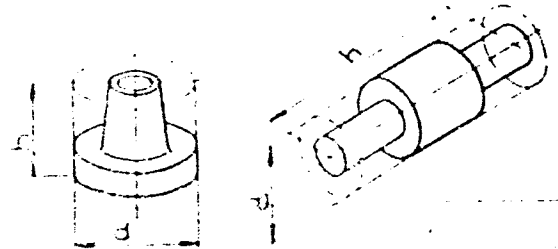


Fig. 1. Die boxes



NOTE :

1. The type of steel used is determined as falling within one of the following categories :
 - a. M1 - steel with carbon content not more than 0.65% and total of specified alloying elements not more than 5%
 - b. M2 - steel with carbon content above 0.65% or total of specified alloying elements above 5%.
2. Complexity factor of a forging is the ratio of the weight of the forging to the weight of the overall shape necessary to accommodate the maximum dimensions of the forging.

The resulting complexity factor is determined as falling within one of the following categories :

- S4 - Upto and including 0.16
- S3 - Above 0.16 upto and including 0.32
- S2 - Above 0.32 upto and including 0.63
- S1 - Above 0.63 upto and including 1.00
